

# Biological Exposure Study aids strontium-90 cleanup

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Radioactive contaminant strontium-90 has affected about a square mile of Hanford groundwater — mostly in the 100N Area, where it has entered the Columbia River at N Springs.

The strontium-90 groundwater plume in the 100N Area is the result of millions of gallons per year of cooling water from N Reactor having been released directly to disposal cribs adjacent to the Columbia River. At one time, concentrations in the center of the groundwater plume were at least a thousand times higher than the drinking-water standard. Concentrations did not begin to diminish until the discharge of contaminants was discontinued in mid-1992.

In the midst of the cleanup challenge, another observation is worth noting. Based on the Pacific Northwest National Laboratory's monitoring of the Columbia River for the U.S. Department of Energy, there is no significant difference in the strontium-90 concentrations at Priest Rapids Dam and the Richland Pump-house.



Periphyton found on rocks, magnified in the inset microscopic photo, represent the bottom of the food chain in the Columbia River. PNNL's Biological Exposure Study team is investigating the effects of strontium-90 on a food web, including rainbow trout that are representative of chinook salmon and steelhead.

Studies are under way to evaluate the effect of strontium-90 on the aquatic ecosystem. PNNL's Biological Exposure Study, within the Science and Technology Project of Fluor Hanford's Groundwater Protection Program, is one such effort. By performing the study, PNNL is addressing questions that have surfaced in past ecological assessments conducted at the Hanford Site. And information from the study will become available for assessments addressing the relative impacts from both Hanford-related sources and upstream background sources of strontium-90.

"Previous risk assessments relied mostly on strontium-90 biological exposure data for sites and species other than those found at Hanford," said PNNL senior research scientist Amoret Bunn. "New site-specific data generated by the strontium-90 study should reduce uncertainty when estimating risk and provide decision makers with information vital to cleanup decisions involving the 100N Area shoreline."

## Uptake and loss

The Biological Exposure Study follows strontium-90 as it makes its way through food and water sources into organisms in the Columbia River. A simple food chain for the Columbia River starts with the periphyton community (the greenish-brown slime found on river rocks), moves to aquatic insects that eat periphyton, and ends with the fish that eat aquatic insects and are directly exposed to strontium-90 in river water.

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## Biological Exposure Study aids strontium-90 cleanup, cont.

After investigating in the laboratory the effects of strontium-90 on periphyton, team members of the Biological Exposure Study have turned their attention to investigating the effects of strontium-90 on salmonids — including fall chinook and steelhead. For this portion of the study, the scientists are using rainbow trout. Although not directly representative of salmon, rainbow trout are from the salmonid family and are easier than salmon to work with in the laboratory.

PNNL is quantifying the rate at which rainbow trout take up strontium-90 from water into their gills, gut, bones and tissue. The lab is also quantifying the uptake from strontium-90-laced food sources.

Another important part of understanding how strontium-90 affects aquatic organisms is quantifying how organisms lose the contaminant through depuration (respiration or excretion). During the Biological Exposure Study, organisms are exposed to known concentrations of strontium-90, and then placed in clean water so the rate of depuration can be quantified.

### Challenge at 100N

Because of the proximity of the strontium-90 groundwater plume of the 100N Area to the Columbia River, the Groundwater Protection Program is looking for remedial technologies that offer the greatest long-term effectiveness.

“The existing pump-and-treat system at 100N has proven to be an inefficient option for long-term remediation,” said physical scientist Mike Thompson of the Department of Energy Richland Operations Office. “Strontium-90 adheres to soil particles and is very difficult to extract via pump-and-treat technology. And we need to assess the environmental impacts of the strontium-90 that reaches the riparian and aquatic environments to make sound remediation decisions. A workshop we’re planning for August will facilitate an exchange of information on contaminant levels at 100N as well as associated human health and environmental risks.”

The upcoming workshop will be designed to foster discussions on the path forward for 100N groundwater and the environmental protection of the Columbia River. A topic of discussion will be the aquatic eco-receptor study.

“Following the workshop, we plan on initiating a Data Quality Objectives process with the regulators to ensure that planned studies meet the intent of Tri-Party Agreement milestones and the requirements of Superfund,” said Thompson. ■